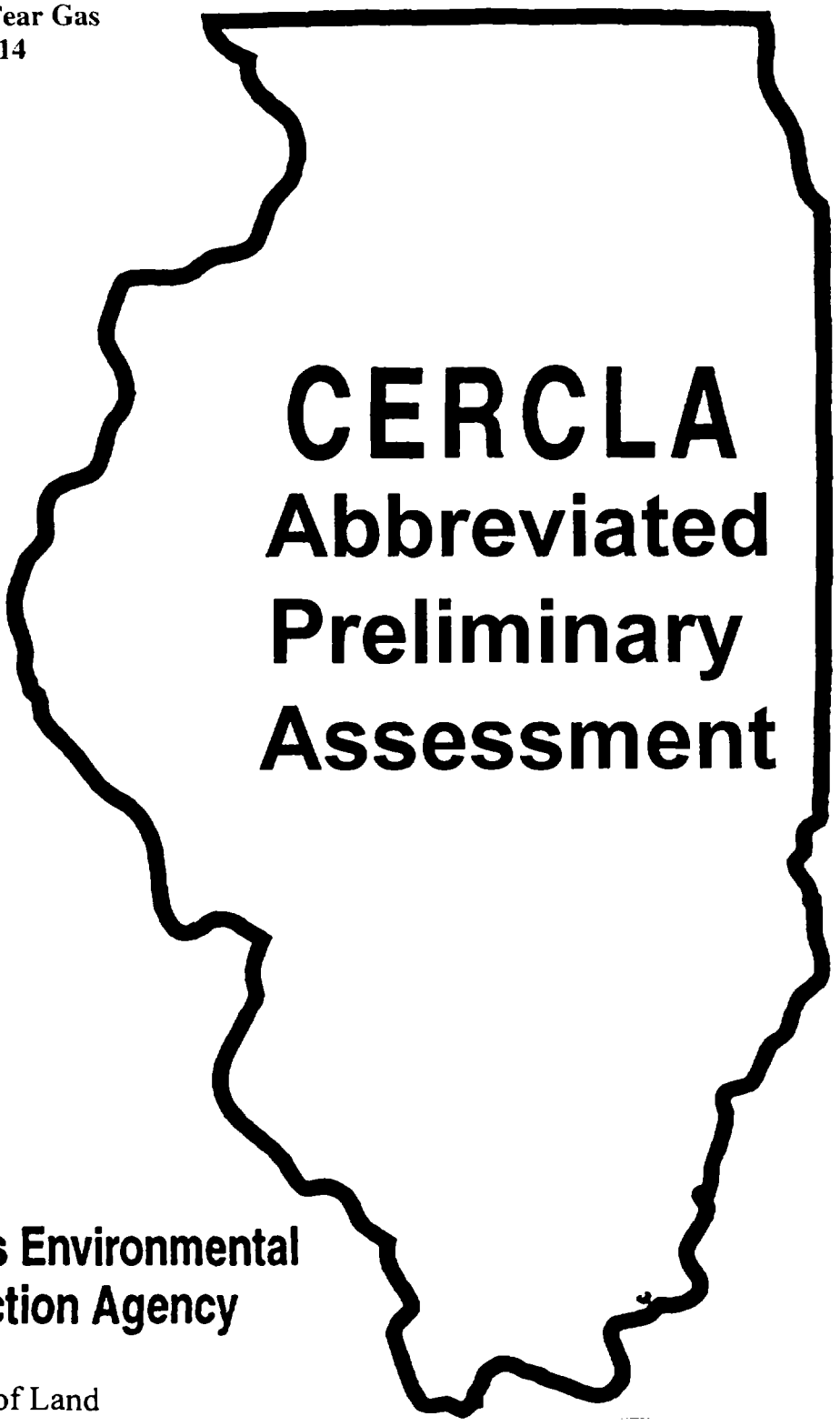
LPC 0316495142 Cook County
109th Place Tear Gas
IL 0000027714
SF/HRS



CERCLA Abbreviated Preliminary Assessment

Illinois Environmental Protection Agency

Bureau of Land
Federal Sites Remediation Section
Site Assessment Unit

ABBREVIATED PRELIMINARY ASSESSMENT

for:

109th Place Tear Gas
IL0000027714
Chicago, Illinois

PREPARED BY:
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
BUREAU OF LAND
DIVISION OF REMEDIATION MANAGEMENT
FEDERAL SITE REMEDIATION SECTION
SITE ASSESSMENT UNIT

January 2002

SITE SUMMARY AND RECOMMENDATION

SITE DESCRIPTION AND HISTORY

Illinois Environmental Protection Agency's Site Assessment Program was tasked by the United States Environmental Protection Agency (U.S. EPA) to conduct an Abbreviated Preliminary Assessment of the 109th Place Tear Gas. The 109th Place Tear Gas site is a residence located on a corner lot at 56 West 109th Place, Chicago, Cook County, Illinois. The area is primarily residential in nature, with some light industrial areas. The house is a wooden, two-story home, which is divided into two apartments, one on each of the two levels.

At approximately 1:00 p.m. on September 30, 1993, a 14-year-old boy and his 6-year-old brother found a canister of tear gas near the house. They brought the canister into the house. Once in the kitchen of the first floor apartment, the boys pulled the pin. A yellow plume of smoke flowed from the detonated grenade and it started to tick. The boys threw the grenade into a garbage can where it exploded. Smoke and gas filled the house forcing 16 occupants to evacuate. The boys brought the garbage can with them as they exited, setting it outside the east side of the house. Chemical dust settled in the first floor kitchen and pantry.

The first floor of the house, where the emergency took place consists of a living room, a dining room, three bedrooms, a bathroom, a kitchen, and a pantry area. The canister had been detonated in the kitchen, and therefore contamination was mainly restricted to the kitchen and pantry areas. The powder was in a light layer on the floor in the kitchen, in a circular area approximately 1 yard in diameter. Also affected was the pantry; the other rooms of the house did not appear to have been affected by the powder. Fumes from the powder appeared to have filled the house.

Personnel from the City of Chicago Energy and Environmental Division (CEED), Chicago Fire Department, and Chicago Police arrived at the Site. Upon entering the house, several firefighters were overcome with gas fumes and were taken to the hospital, along with some of the residents. Chicago Police secured the area, restricting access to the Site. A representative from the CEED responded to the Site, as well as the On-Scene Coordinator (OSC) for the United States Environmental Protection Agency (EPA), Stavaros Emmanouil. Ecology and Environment, Inc. (E&E), EPA's Technical Assistance Team (TAT), also

responded and conducted an emergency site assessment. City of Chicago personnel temporarily relocated the Site residents.

In interviews after the incident, the younger of the two brothers remembered seeing the code "CS 237" on the side of the canister. Later, in conversations with *military personnel, the Chicago Fire Department Hazardous Incidents Team* learned that CS 237 is a type of tear gas also known as pepper gas or ortho-chlorobenzylidenemalononitrile. CS is a military code name meaning Cry Slow. Even in extremely low concentrations CS 237 irritates eyes, the respiratory system, and mucous membranes (United States Army Field Manual, Military Chemistry and Chemical Compounds, FM 3-9, October 1975, Attachment B). CS 237 can cause nausea and in high concentrations can be lethal. CS 237 produces maximum effects within 20-60 seconds of exposure. Although concentrations of CS 237 were not measured at the Site, the effects of firefighters and residents indicate concentrations of CS 237 at or above incapacitating levels.

EPA approved Emergency Response cleanup Services (ERCS) funds to initiate the CS 237 removal on October 1, 1993. Due to the fact that this was an immediate removal the site was placed on CERCLIS. That same day, TAT personnel vacuumed all first floor rooms with a self-contained vacuum, removing as much contamination as possible. The TAT washed all floors, walls, and ceilings of the kitchen and pantry. All loose items found in the kitchen and pantry was washed. The TAT bagged and removed some of the affected material including all loose clothing in the bedrooms. On October 2, 1993, all waste generated during the removal process was sealed in five drums, labeled non-hazardous waste, and the clean up was completed. On January 12, 1994, the ERCS contractor resealed, labeled, and transported the drums to landfill and wastewater treatment facilities.

CURRENT SITE CONDITIONS/ACTIVITIES

There is no municipal groundwater use in the area as the City of Chicago obtains its water supply from Lake Michigan. There are no surface water drainage ways in the vicinity of the site and any runoff from the site enters storm sewers. The soil pathway was eliminated due to the immediate action by USEPA. Completion of CS 237 removal activities eliminated direct contact threats to the public. There has been no apparent migration of wastes from the facility to the neighboring areas and no complaints have been filed about the property. The Site remains a two-story apartment, one on each level. The first level was the only level affected by the CS 237.

RECOMMENDATION

At this time it appears that the 109th Place Tear Gas Site in Chicago, Illinois does not pose a threat to the target population within the established pathway. The U.S. EPA Region 5 CERCLA Removal Program has addressed the immediate threat by overseeing the removal of the hazardous wastes from the facility, and thus, removing the threat to all pathways. It is recommended that this site receive a no further action rating and be placed in the archived CERCLIS database.

ATTACHMENT A

ABBREVIATED PRELIMINARY ASSESSMENT CHECKLIST

ABBREVIATED PRELIMINARY ASSESSMENT CHECKLIST

This checklist can be used to help the site investigator determine if an Abbreviated Preliminary Assessment (APA) is warranted. This checklist should document the rationale for the decision on whether further steps in the site investigation process are required under CERCLA. Use additional sheets, if necessary.

Checklist Preparer: Tony Wasilewski/EPS I
Name/Title
1021 N. Grand Ave East, Spfld. IL 62794
Address
Tony.Wasilewski@epa.state.il.us
E-mail Address

January 9, 2002
Date
217-557-3200
Phone

Site Name: 109th Place Tear Gas

Previous Names (if any): _____

Site Location: 56 W. 109th Place
Chicago, IL 60628

Latitude: _____

Longitude: _____

Describe the release (or potential release) and its probable nature:

On September 30, 1993 a 14-year-old boy and his 6-year-old brother found a canister of CS 237, tear gas, in there back yard and brought it into the house and detonated the canister. Chemical dust settled on the first floor kitchen and pantry. On October 1, 1993 EPA was tasked to do a removal of the powdered substance from the house.

Part 1 - CERCLA Eligibility Evaluation

If the answer to any one of these is Ayes,≡ the site can be considered NFRAP or archived	YES	NO
1. Is the site nonexistent, or is it not a duplicate (or Aalias≡) of another site?	~	X
2. Is the site being addressed by some other remedial program (Federal, State, or Tribal)?	~	X
3. Are the hazardous substances potentially released at the site regulated under a statutory exclusion (e.g., petroleum, natural gas, natural gas liquids, synthetic gas usable for fuel, normal application of fertilizer, release located in a workplace, naturally occurring, or regulated by the NRC, UMTRCA, or OSHA)?	~	X
4 Are the hazardous substances potentially released at the site excluded by policy considerations (e.g., deferred to RCRA corrective action, FIFRA, or Brownfields)?	~	X
5. Is there sufficient documentation to demonstrate that no potential for a release that could cause adverse environmental or human health impacts, (e.g., comprehensive remedial investigation equivalent data showing no release above ARARs, completed removal action, previous HRS score determined, or an EPA approved risk assessment completed)?	X	~

Please explain all yes answer(s).

The site was tasked for an immediate removal on October 1 and 2, 1993. A Prescore package was prepared and documentation was made that the threat of potential release no longer exists.

Part 2 - Initial Site Evaluation

Use Exhibit 1 of this fact sheet to make site assessment decisions based on the answers below:	YES	NO
Does documentation indicate that a target (e.g., drinking water wells, drinking surface water intakes, etc.) has been exposed to a hazardous substance released from the site?	~	X
Is there an apparent release at the site with no documentation of exposed targets, but there are targets on site or immediately adjacent to the site?	~	X
Is there an apparent release and no documented on-site targets or targets immediately adjacent to the site, but there are nearby targets (e.g., targets within 1 mile)?	~	X
Is there no indication of a hazardous substance release, and there are uncontained sources containing CERCLA hazardous substances, but there is a potential to release with targets present on site or in proximity to the site?	~	X
Does the site lack documented on-site, adjacent, or nearby targets?	~	X
Does the site lack releases or potential to release?	X	~
Does the site lack uncontained sources containing CERCLA eligible substances are present on site?	X	~

Please explain all yes answer(s). All releases and potential releases have been removed from the site. The CS 237 canister was removed from the site and all powdered substance was vacuumed and all loose clothing was remove as well as the kitchen and pantry thoroughly washed.

Part 3 - EPA Regional Review and Site Assessment Decision

Check the box(es) that apply.

~ NFRAP/Archive
~ APA
~ Full PA
~ Combined PA/SI
~ SI
~ Removal Action
~ Other:_____

Lead Agency or Defer/Refer to:

~ EPA Remedial Program
~ Removal Program
~ State/Tribal Program
~ RCRA
~ Brownfields
~ Other Federal Agency:_____
~ Other:_____

Regional EPA Reviewer: _____ _____
Print Name/Signature Date

ATTACHMENT B

MILITARY CHEMISTRY
AND
CHEMICAL COMPOUNDS

ARMY FM 3–9
AIR FORCE AFR 355–7

FIELD MANUAL

MILITARY CHEMISTRY AND CHEMICAL COMPOUNDS

HEADQUARTERS, DEPARTMENT OF THE ARMY
OCTOBER 1975

per gram at 20° C.; 55.7 calories per gram at boiling point.

(14) *Rate of hydrolysis.* Very slow.

(15) *Hydrolysis products.* Complex condensation products.

(16) *Stability in storage.* Fairly stable in glass, leadlined, or enamel-lined containers.

(17) *Action on metals or other materials.* Vigorous corrosive action on all common metals except lead. Reaction with iron may be explosive.

(18) *Odor.* Like soured fruit, but not unpleasant.

(19) *Median lethal dosage (LCt_{50}).* Estimated 8,000 to 11,000 mg-min/m³. Volatility is too low to permit attaining a lethal dosage in the field. Lethal dosage may be obtained in enclosed places.

(20) *Median incapacitating dosage (ICt_{50}).* About 30 mg-min/m³.

(21) *Rate of detoxification.* Rapidly detoxified at the low concentrations ordinarily encountered.

(22) *Skin and eye toxicity.* Irritating; not toxic.

(23) *Rate of action.* Instantaneous.

(24) *Physiological action.* CA produces a burning sensation of the mucous membranes and severe irritation and lacrimation of the eyes with acute pain in the forehead.

(25) *Protection required.* Protective mask.

(26) *Decontaminants.* Clothing can be decontaminated by steam or by boiling. Twenty percent alcoholic caustic soda is effective on material, but may damage it. Porous surfaces, such as earth, are very difficult to decontaminate.

(27) *Persistency.* Depends on munitions used and the weather. Heavily splashed liquid persists 1 to 2 days under average weather conditions.

(28) *Use.* Obsolete. But is included to present a complete coverage of all potential military chemicals.

g. O-chlorobenzylidene malononitrile (CS).

(1) *General.* For riot control CS exists as a family of three forms: CS, CS1, and CS2. CS identifies the white crystalline form. It has a minimum purity of 96 percent; it is insoluble in water and ethanol, but is soluble in methylene chloride. CS is thermally dispersed as a solid aerosol. CS1 is a mixture consisting of 95 percent crystalline CS blended with 5 percent silica aerogel to reduce agglomeration, and micropulverized to 3- to 10-micron size to achieve the desired respiratory effects when dispersed as a solid aerosol. CS2 is CS containing a hydrophoric compound, Cab-O-sil, which improves the physical characteristics of CS by reducing agglomeration and hydrolysis.

(2) *Chemical name.* O-chlorobenzylidene malononitrile.

(3) *Formula.* $ClC_6H_4CHC(CN)_2$.

(4) *Molecular weight.* 188.5.

(5) *Density.* 1.04 g/cc crystalline density; 0.24 – 0.26 g/cc bulk density.

(6) *Melting point.* 93° to 95° C.

(7) *Boiling point.* 310° to 315° C. (with decomposition).

(8) *Volatility.* 0.71 mg/m³ at 25° C.

(9) *Flash point.* 197° C.

(10) *Decomposition temperature.* Unknown.

(11) *Heat of vaporization.* 53.6 calories per gram.

(12) *Rate of hydrolysis.* Rapid for dissolved CS. CS is only slightly soluble in water (about 0.008 weight percent at 25° C.); thus solid CS in water is hydrolyzed relatively slowly.

(13) *Hydrolysis products.* O-chlorobenzaldehyde and malononitrile.

(14) *Stability in storage.* Stable.

(15) *Action on metals.* Very slight action on steel.

(16) *Odor.* Pepper-like.

(17) *Median lethal dosage (LCt_{50}).* 61,000 mg-min/m³ (M7A3 grenade).

(18) *Median incapacitating dosage (ICt_{50}).* 10 to 20 mg-min/m³.

(19) *Rate of detoxification.* Quite rapid. Incapacitating dosages lose their effects in 5 to 10 minutes.

(20) *Skin and eye toxicity.* Highly irritating but not toxic.

(21) *Rate of action.* Very rapid.

(22) *Physiological effects.* CS produces immediate effects even in extremely low concentrations. The median effective concentration for respiratory effects is 12 to 20 mg/m³; concentration for eye effects is 1 to 5 mg/m³. The onset of maximum effects is 20 to 60 seconds and the duration of effects is 5 to 10 minutes after the affected individual is removed to fresh air. During this time affected individuals are incapable of effective concerted action. The physiological effects include extreme burning of the eyes accompanied by copious flow of tears; coughing, difficulty in breathing, and chest tightness; involuntary closing of the eyes; stinging sensation of moist skin; runny nose; and dizziness or swimming of the head. Heavy concentrations will cause nausea and vomiting in addition to the above effects.

(23) *Protection required.* Protection is provided by the protective mask and ordinary field

clothing secured at the neck, wrist, and ankles. Personnel handling CS should wear rubber gloves for additional protection.

(24) *Decontaminants.* Personnel affected by CS in field concentrations should move to an uncontaminated area, face into the wind, and remain well spaced. They should be warned not to rub their eyes or scratch irritated skin areas. Normally, aeration is sufficient to decontaminate personnel and to dissipate ill effects of the compound in 5 to 10 minutes. Personnel contaminated with visible CS particles should flush their bodies or affected parts with cool water for 3 to 5 minutes before showering with warm or hot water.

(25) *Munitions suitable for use.* CS is used as filling for burning-type grenades and for capsules. CS1 is used as filling for bursting-type grenades and in bulk agent dispersers. CS2 is used as filling in bulk agent dispersers.

(26) *Persistency.* Varies, depending upon amount of contamination.

(27) *Use.* Training and riot control; limited tactical use in counterguerrilla operations.

3-11. Miscellaneous

a. Chlorine.

(1) *Chemical name.* Chlorine.

(2) *Formula.* Cl_2.

(3) *Molecular weight.* 70.91.

(4) *Vapor density (compared to air).* 2.4.

(5) *Liquid density.* 1.41 at 20° C.

(6) *Melting point.* −101° C.

(7) *Boiling point.* −34.5° C.

(8) *Vapor pressure.* 4,992 mm Hg at 20° C.

(9) *Volatility.* 19,369,000 mg/m³ at 20° C.

(10) *Flash point.* None.

(11) *Decomposition temperature.* Greater than 1,000° C.

(12) *Latent heat of vaporization.* 68.8 calories per gram.

(13) *Rate of hydrolysis.* Slow.

(14) *Hydrolysis products.* HCl and HOCl.

(15) *Stability in storage.* Stable when dry.

(16) *Action on metals or other materials.* None in field concentrations if C1 is dry. Vigorous action with metals when C1 is moist.

(17) *Odor.* Pungent, like bleaching powder.

(18) *Median lethal dosage (LCt_{50}).* 19,000 mg-min/m³.

(19) *Median incapacitating dosage (ICt_{50}).* 1,800 mg-min/m³.

(20) *Rate of detoxification.* Rapid.

(21) *Skin and eye toxicity.* Irritates eyes.

(22) *Rate of action.* Rapid.

(23) *Physiological action.* Powerful irritant, first on upper and then on lower respiratory tract.

(24) *Protection required.* Protective mask.

(25) *Decontaminants.* None required.

(26) *Persistency.* Short.

(27) *Use.* No longer authorized for training. However, C1 is included in this manual because of the potential danger of a commercial accident or incident.

b. Simulated Mustard (MR).

(1) *General.* After World War I, a number of substances having physical properties similar to those of HD and generally containing a dye and an odoriferous constituent were tested in an attempt to find a substitute for mustard in the testing of dispersion apparatus and munitions and for training purposes. Almost all of the substances had some disadvantageous feature, such as instability, corrosiveness to metals, staining to fabrics, relatively high cost, or, in the case of those containing aniline and nitrobenzene, some toxicity. The use of molasses residuum solution (MR) as a simulant for HD was first suggested in March 1937. Since that time MR has been used successfully in tests of airplane smoke tanks, thin-case bombs, and chemical land mines. MR is adaptable to some training needs in that it is relatively persistent and readily identifiable.

(2) *Name and formula.* MR is a mixture consisting of a 25 percent solution by volume of molasses residuum in water. Molasses residuum is obtained in the manufacture of ethyl alcohol from molasses.

(*a*) As obtained from industry, the concentrated molasses residuum is a dark-brown viscous liquid with a characteristic molasses odor. It is soluble in water to the extent of 90 percent.

(*b*) The undiluted material is more viscous than HD; but when one volume of molasses residuum is diluted with three volumes of water, it forms a dark-brown liquid of thin, sirupy consistency which, although it has a lower specific gravity than either pure or crude mustard, has a viscosity and surface tension sufficiently close to those of HD to insure comparable flow characteristics.

(*c*) It has a low freezing point and can be used in moderately cold weather without danger of freezing.

(*d*) The solution has a distinctive molasses odor which, while not similar to that of HD, is readily recognizable. When the solution is sprayed from an airplane, the molasses odor can

AGENTS	Chemical agent; formula; symbol	Molecular weight	State at 20°C.	Vapor density (air-1)	Liquid density (g/cc)	Freezing/ melting point (°C.)	Boiling point (°C.)	Vapor pressure mm.	Volatility (mg/m³)	Flash po
CHOKING AGENTS	Phosgene $COCl_2$ CG	98.92	Colorless gas	3.4	1.37 at 20° C.	−128	7.6	1.173 at 20° C.	4,300,000 at 7.6° C.	None
	Diphosgene $ClCOOCCl_3$ DP	197.85	Colorless liquid	6.8	1.65 at 20° C.	−57	127 to 128	4.2 at 20° C.	45,000 at 20° C.	None
NERVE AGENTS	Tabun $(CH_3)_2NP(O)$-$(C_2H_5O)(CN)$ GA	162.8	Colorless to brown liquid	5.63	1.073 at 25° C.	−50	240	0.07 at 25° C.	610 at 25° C.	78° C.
	Sarin $(CH_3)_2CHO$-$(CH_2)FPO$ GB	140.10	Colorless liquid	4.86	1.0887 at 25° C.	−56	158	2.9 at 25° C.	22,000 at 25° C.	Nonflammable
	Soman $(CH_3)_2CCH$-$(CH_3)OPF(O)$-CH_3 GD	182.178	Colorless liquid	6.33	1.0222 at 25° C.	−42	198	0.4 at 25° C.	3,900 at 25° C.	High enough not to interfere with military use
TEAR AGENTS	phenone $C_6H_5COCH_2Cl$ CN				20° C. (solid)			20° C.	20° C.	not to interfere with military use
	Chloroacetophenone in chloroform CNC	126.17 on basis of components	Liquid	4.4	1.40 at 20° C.	0.23	Variable-60 to 247	127 at 20° C.	Indeterminate	None
	Chloroacetophenone and chloropicrin in chloroform CNS	141.78 on basis of components	Liquid	Approx. 5	1.47 at 20° C.	2	Variable-60 to 247	78 at 20° C.	610,000 at 20° C. (includes solvent)	None
	Chloroacetophenone in benzene and carbon tetrachloride CNB	119.7 on basis of components	Liquid	Approx. 4	1.14 at 20° C.	−7 to −30	Variable-75 to 247	Variable-mostly solvent vapor	Indeterminate	Below 4.44
	Bromobenzylcyanide $BrC_6H_4CH_2CN$ CA	196	Liquid	6.7	1.47 at 25° C.	25.5	Decomposes at 242	0.011 at 20° C.	115 at 20° C.	None
	O-chlorobenzylmalononitrile ClC_6H_4CHC-$(CN)_2$ CS	188.5	Colorless solid	-	1.04 at 20° C. (solid)	93 to 95	310 to 315(w/ decomposition)	-	0.71 at 25° C.	197° C.
INCAPACITATING AGENT	BZ	337.4	-	11.6	Bulk 0.51 solid	167.5	412	0.03 at 70° C.	0.5 at 70° C.	246° C.

Rate of action	Physiological action	Protection required	Stability	Decontamination	Means of detection in the field	Use
Immediate to 3 hours, depending upon	Damages and floods lungs	Protective mask	Stable in steel if CG is dry	None needed in field; aeration in closed spaces	M18A2 kit; odor	Delayed- or immediate-action casualty agent
Immediate to 3 hours, depending upon concentration	Damages and floods lungs	Protective mask	Unstable; tends to convert to CG	None needed in field; aeration in closed spaces	Odor	Delayed- or immediate-action casualty agent
Very rapid	Cessation of breath and death may follow	Protective mask and clothing	Stable in steel at ordinary temperature	Bleach slurry, dilute alkali, or DS2; steam and ammonia in confined area; M258 kit	M15A2A and M18A2 kits	Quick-action casualty agent
Very rapid	Cessation of breath and death may follow	Protective mask and clothing	Stable when pure	In confined area steam and ammonia; hot soapy water; M258 kit	M15A2A and M18A2 kits	Quick-action casualty agent
Very rapid	Cessation of breath and death may follow	Protective mask and clothing	Stable when pure	Bleach slurry, dilute alkali, in confined area hot soapy water; M258 kit	M15A2A and M18A2 kits	Quick-action casualty agent
	irritates respiratory tract	mask		open; soda ash solution or alcoholic caustic soda in closed spaces	and alkali in white-band tube of detector kit	riot control agent
Instantaneous	Lacrimatory; irritates respiratory tract	Protective mask	Adequate	Aeration in open; soda ash solution or alcoholic caustic soda in closed spaces	M-nitrobenzene and alkali in white-band tube of detector kit	Training and riot control agent
Instantaneous	Acts as vomiting and choking agent as well as tear agent	Protective mask	Adequate	None needed in field; hot solution of soda ash and sodium sulfite in closed spaces	CN test, as alkaline sulfite in blue-band tube of detector kits	Former training and riot control agent
Instantaneous	Powerfully lacrimatory	Protective mask	Adequate	Aeration in open; soda ash solution or alcoholic caustic soda in closed spaces	M-nitrobenzene and alkali in white-band tube of detector kit	Former training and riot control agent
Instantaneous	Irritates eyes and respiratory passages	Protective mask	Fairly stable in glass, lead or enamel	20% alcoholic caustic	M-nitrobenzene and alkali in white-band tube of detector kit	Former training and riot control agent
Instantaneous	Highly irritating; but not toxic	Protective mask and clothing	Stable	Water, 5% sodium bisulfite, and water rinse	None	Training and riot control agent
Delayed action 1 to 4 hours	Fast heartbeat, dizziness, vomiting, dry mouth, blurred vision, stupor, increasing random activity	Protective mask	Adequate	Wash with soap and water; shake or brush; hypochlorite or caustic alcoholic solutions; detergent wetting solutions	None	Former delayed action temporarily incapacitating agent

Table 2–1. Properties of Chemical Agents

Flash point	Decomposition temperature (°C.)	Heat of vaporization	Odor	Median lethal dosage (mg-min/m³)	Median incapacitating dosage (mg-min/m³)	Rate of detoxification	Eye and skin toxicity
None	800	59	New-mown hay; green corn	3,200	1,600	Not detoxified-cumulative	None
None	300 to 350	–	New-mown hay; green corn	3,200	1,600	Not detoxified-cumulative	Slightly lacrimatory
78° C.	150	79.56	Faintly fruity; none when pure	400 for resting men	300 for resting men	Slight but definite	Very high
Nonflammable	150	80	Almost none when pure	100 for resting men	75 for resting men	Cumulative	Very high
High enough not to interfere with military use	130	72.4	Fruity; camphor odor when pure	GB, GA range	GB, GA range	Low; essentially cumulative	Very high
not to interfere with military use	boiling point		blossoms				severe eye irritation; mild skin irritation
None	Stable to boiling point	Not applicable	Chloroform	About 11,000 (estimated)	80	Rapid	Temporary severe eye irritation; mild skin irritation
None	Stable to boiling point	Not applicable	Flypaper	11,400	60	Slow because of effect of PS	Irritating; not toxic
Below 4.44	Above 247	Not applicable	Benzene	About 11,000 (estimated)	80	Rapid unless large amounts of solvent inhaled	Temporary severe eye irritation; mild skin irritation
None	60 to 242	55.7	Soured fruit	8,000 to 11,000 (estimated)	30	Rapid in low dosage	Irritating; not toxic
197° C.	–	53.6	Pepper	61,000	10 to 20	Rapid; sublethal in 5 to 10 minutes	Highly irritating; not toxic
246° C.	Begins at 170° C.	62.9	–	–	–		–

ARMY TM 8-285
NAVY NAVMED P-5041
AIR FORCE AFM 160-12

TREATMENT OF CHEMICAL AGENT CASUALTIES AND CONVENTIONAL MILITARY CHEMICAL INJURIES

DEPARTMENTS OF THE ARMY, THE NAVY, AND THE AIR FORCE
MAY 1974

PART TWO

CONVENTIONAL MILITARY CHEMICAL INJURIES

CHAPTER 9

RIOT CONTROL AGENTS (IRRITANT AGENTS AND VOMITING AGENTS

Section I. IRRITANT AGENTS

9-1. General

Irritant agents, or lacrimators, are local irritants which, in very low concentrations, act primarily on the eyes, causing intense pain and lacrimation. Higher concentrations irritate the upper respiratory tract and the skin and sometimes cause nausea and vomiting. These agents may be dispersed as fine particulate aerosols (smokes) or in solutions as droplet aerosols. Examples of irritant agents are o-chlorobenzylidene malononitrile (CS), chloroacetophenone (CN), and brombenzylcyanide (CA). They are used primarily in training and in riot control, although CS may also be used in combat. Some pulmonary irritants, such as chloropicrin and cyanogen chloride, are also lacrimators.

9-2. Protection

a. Protection is provided by the standard protective mask and ordinary field clothing secured at the neck, wrists, and ankles. The protective hood may also be worn with the mask. Individuals who handle CS should wear rubber gloves for additional protection.

b. Following exposure, clothing and individual equipment should be inspected for agent residue. If agent residue is found, individuals should change or decontaminate clothing to protect themselves and other unmasked persons.

9-3. Properties

a. Agent CS. The agent CS is a white crystalline solid which melts at 194° F. (90° C.) and is stable under ordinary conditions of storage. It has a pungent, pepper-like odor. The CS cloud is white at the point of release and for several seconds after release. The agent is disseminated by burning, explosion, and aerosol formation. It may also be used in liquid form, in an appropriate solvent. CS is faster acting, about 10 times more potent, and less toxic than CN.

b. Agents CN and CA. CN is a white crystalline solid, melting at 129° F. (54° C.). CA is usually a liquid, boiling at 468° F. (242° C.) and freezing at 77° F. (25° C.) CN may also be used in liquid form, in appropriate solvents. Th odor, if any, of CN and CA may be faint an agreeable. The odor of CN has been likened to that of apple blossoms. The odor of CA has been likened to that of sour fruit. These agents may appear as a bluish-white cloud at the point of release. Solid agent is dispersed as fine particulate smoke and as vapor from burning munitions such as lacrimator candles and grenades. Liquid agent may be dispersed from airplane spray or bursting munitions.

9-4. Effects

a. Agent CS.

(1) *Eyes and respiratory tract.* When an unmasked person enters a cloud of CS, the effects are felt almost immediately. Incapacitation begins in 20 to 60 seconds, depending upon agent concentration. Duration of effects is 5 to 10 minutes after removal to fresh air. During exposure an individual is incapable of effective concerted action. There is marked burning pain in the eyes with copious lacrimation, blepharospasm, thin mucous nasal discharge, coughing, and dyspnea. Following heavy exposures there may be nausea and vomiting. Exposure to extremely high concentration in an enclosed space

cause tracheitis and bronchitis. Even if that happens, permanent damage is very unlikely.

(2) *Skin.* Warm, moist skin, especially on the face, neck, ears, and body folds, is susceptible to irritation by CS. Stinging sensation may occur promptly, even at moderately low concentrations. Higher concentrations may cause an irritant dermatitis with erythema and, rarely, blisters on the same body regions. Stinging subsides after 5 to 10 minutes, even with continued exposure. An increase in the stinging is commonly noted upon the individual's removal to fresh air. Repeated exposures may cause delayed hypersensitivity with allergic contact dermatitis. Individuals engaged in bulk handling and exposed to large quantities of CS or CS-2 report stinging sensations in warm, moist skin areas. Inflammation and blistering similar to sunburn may occur after heavy or prolonged exposure, especially if the individual's skin is fair. The following solution can be applied as wash or spray to cleanse unbroken skin of CS handlers, but it is painful in the eyes or in wounds, normal saline should be used there. To make the solution, add 100 grams of sodium bicarbonate, 50 grams of sodium carbonate, and 15 milliliters of 10 percent benzalkonium chloride solution to 1,500 milliliters of distilled water. The solution is stable and should be prepared in advance of need. The pharmacy may issue the solution to CS handlers as required, without prescription. An example of a burn caused by CS is shown in figure 9-1.

b. Agents CN and CA.

(1) *Eyes and respiratory tract.* The vapors or smokes of these agents cause basically the same reactions as does CS. However, their toxicities are generally higher and their effectiveness as lacrimators generally lower than CS; that is, higher concentrations of CN or CA are required to produce an irritant effect equivalent to that of CS. Recovery is quick if exposure is brief but more prolonged exposure may cause conjunctivitis and photophobia. Extremely high concentrations of these agents in inclosed spaces may cause tracheitis, bronchitis, pulmonary edema, or cerebral edema. Exposures of this magnitude are rare.

(2) *Skin.* Stinging of the skin and, with higher concentrations, irritant dermatitis may occur in warm, humid weather. These agents are potential skin sensitizers although apparently less so than CS. Droplets of liquid or particles of solid lacrimators in the eyes may be corrosive and produce burns like those of strong acid.

9-5. Diagnosis

a. Agent CS. Diagnosis of exposure to CS is

Figure 9-1. Burn caused by CS.

made from the pepper-like odor, the presence of intense eye effects, dyspnea, coughing, and mucous rhinorrhea.

b. Agents CN and CA. Diagnosis of exposure to these agents is made from their odors and from the marked coughing and dyspnea relative to the eye effects. Also, headache and depression of spirits may appear as late effects of CN exposure.

9-6. Self-Aid

Put on the protective mask, clear it, and keep your eyes open as much as possible. Escape the contaminated environment if possible. When vision clears, go on with your duties. When it is safe to do so, remove the mask and blot away tears. Do not rub the eyes. If drops or particles have entered the eye, try forcibly to open the eye and flush it with copious amounts of water from the canteen. Chest discomfort usually can be relieved merely by talking. If exposure has been heavy, significant cutaneous reaction may develop. The individual may prevent this by immediately flushing his skin with copious amounts of water. Five percent or 10 percent sodium bicarbonate or sodium bicarbonate in water, or a specially prepared cutaneous wash solution (6.7% $NaHCO_3$, 3.3% NA_2CO_3, and 0.1% benzalkonium chloride in water), is superior to water and need be used only in small amounts. Such solutions should not be used in the eyes.

9-7. Treatment

a. Eyes. Ordinarily, the effects on the eyes are self-limiting and do not require treatment. If large particles or droplets of agent are in the eye, treatment as for corrosive materials may be required. This is much less likely in CS exposure than in CN or CA exposure. Prompt irrigation of the eye with copious amounts of water is essential. Impacted particles of agent may be removed mechanically. After complete decontamination an ophthalmic corticosteroid ointment may be used. Patients heavily exposed to CN or CA must be observed closely for development of corneal opacity and iritis. If either condition develops, the patient should be evacuated promptly for definitive ophthalmologic treatment.

b. Skin. Early (up to 1 hour) erythema and stinging ordinarily are transient and do not require treatment. Delayed erythema (irritant dermatitis) may be treated with a bland shake lotion, such as calamine lotion, or a topical corticosteroid (0.10% triamcinolone acetonide; 0.025% fluocinolone acetonide; 0.05% flurandrenotone), depending upon severity. Cases with blisters should be managed like an equivalent second degree burn. Oozing in acute contact dermatitis is treated with wet dressings of 1 to 40 Burow's solution or colloidal oatmeal for 30 minutes, three times daily. The topical steroid should follow the wet dressing immediately. Secondary infections are treated with appropriate antibiotics. If significant pruritis occurs, an oral antihistamine should be used.

c. Pulmonary. In the rare event of pulmonary effects following massive exposure, evacuation for hospital care is required. Treatment is basically the same as for choking agents (chap 6).

9-8. Prognosis

Most persons affected by irritant agents require no medical attention. Casualties are rare. Severe reactions of the eyes or the skin may take days or weeks to heal, depending upon their severity.

Section II. VOMITING AGENTS

9-9. General

Vomiting agents produce strong pepper-like irritation in the upper respiratory tract with irritation of the eyes and lacrimation. They cause violent uncontrollable sneezing, cough, nausea, vomiting, and a general feeling of bodily discomfort. The principal agents in this group are diphenylchloroarsine (DA), diphenylaminochloroarsine (Adamsite, DM), and diphenylcyanoarsine (DC). They are dispersed as aerosols and produce their effects by inhalation or by direct action on the eyes.

9-10. Protection

The standard protective mask gives adequate protection against field concentrations of vomiting agents. No protective clothing is required.

9-11. Properties

DM, DA, and DC are crystalline solids which are usually dispersed by heat as fine particulate smokes. When concentrated, DM smoke is canary yellow; DA and DC smokes are white. All are colorless when diluted with air. Low concentr